S.Q. TUBE

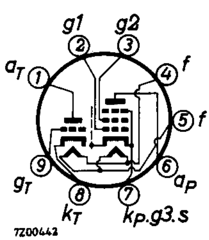
Special quality triode-pentode
The pentode section is designed for use as mixer and R.F. or A.F. amplifier. The triode section is designed for use as oscillator (max. freq. 300 MHz) multivibrator or blocking oscillator.

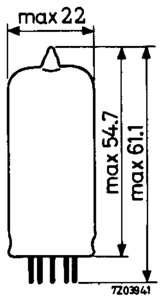
QUICK REFERENCE DATA				
Life test		10 000 hours		
Low interface resistance				
Mechanical quality		Shock and vibration resistant		
Base		Noval. Gold plated pins		
Heating		Indirect A.C. or D.C.; parallel supply		
Heater voltage		V_f	6.3	V
Heater current		I_f	330	mA
Pentode:	Anode current	I_a	10	mA
	Mutual conductance	S	6.2	mA/V
	Amplification factor	μ	40	
Triode:	Anode current	I_a	14	mA
	Mutual conductance	S	5	mA/V
	Amplification factor	μ	18	

DIMENSIONS AND CONNECTIONS

Dimensions in mm

Base: Noval





CHARACTERISTICS

Column I Nominal value or setting of the tube
II Range values for equipment design: Initial spread
III Range values for equipment design: End of life

		I	II	III	
Heater voltage	V_f	6.3			V
Heater current	I_f	330	313 - 347		mA
<u>Pentode section</u>					
Anode supply voltage	V_{ba}	170			V
Grid No.2 supply voltage	V_{bg_2}	170			V
Cathode resistor	R_k	155			Ω
Anode current	I_a	10	7.5 - 12.5	min. 6	mA
Grid No.2 current	I_{g_2}	2.8	1.55 - 4.05		mA
Mutual conductance	S	6.2	5.2 - 7.2	min. 4.3	mA/V
Amplification factor grid No.2 to grid No.1	$\mu_{g_2g_1}$	40			
Internal resistance	R_i	0.4	min. 0.26		MΩ
Negative grid No.1 current	$-I_{g_1}$		max. 0.5	max. 1.0	μA
<u>Triode section</u>					
Anode supply voltage	V_{ba}	100			V
Cathode resistor	R_k	120			Ω
Anode current	I_a	14	10 - 18	min. 8.4	mA
Mutual conductance	S	5.0	4 - 6	min. 3.5	mA/V
Amplification factor	μ	18			
Negative grid current	$-I_g$		max. 0.5	max. 1.0	μA

CAPACITANCES Without external shield

		I	II	
Pentode				
Grid No.1 to grid No.2, grid No.3 cathode, heater and screen	$C_{g1/g2g3kfs}$	5.6	5.2 - 6	pF
Anode to grid No.2, grid No.3 cathode, heater and screen	$C_{a/g2g3kfs}$	3.4	3 - 3.8	pF
Anode to grid No.1	C_{ag1}		max. 25	mpF
Grid No.1 to heater	C_{g1f}		max. 0.16	pF
Triode				
Grid to cathode (triode), cathode (pentode) grid No.3, heater and screen	$C_{g/k_T k_P g_3 fs}$	2.5	2.2 - 2.8	pF
Anode to cathode (triode), cathode (pentode) grid No.3, heater and screen	$C_{a/k_T k_P g_3 fs}$	1.5	1.2 - 1.8	pF
Anode to grid	C_{ag}	1.5	1.2 - 1.8	pF
Grid to heater	C_{gf}		max. 0.22	pF
Pentode to triode				
Anode (pentode) to anode (triode)	C_{aP-aT}		max. 0.07	pF
Anode (pentode) to grid (triode)	C_{aP-gT}		max. 0.02	pF
Grid No.1 (pentode) to anode (triode)	C_{g_1P-aT}		max. 0.16	pF

MICROPHONY

The pentode section can be used without special precautions against microphony in circuits where an input voltage of more than 50 mV is required for an output of 50 mW.

SHOCK AND VIBRATION RESISTANCE

The following test conditions are applied to assess the mechanical quality of the tube. These conditions are not intended to be used as normal operating conditions.

Shock

The tube is subjected 5 times in each of 4 positions to an acceleration of 500 g supplied by an NRL shock machine with the hammer lifted over an angle of 30°.

Vibration

The tube is subjected during 32 hours in each of 3 positions to a vibration frequency of 50 Hz with an acceleration of 2.5 g.

LIFE

Production samples are tested to be within the end of life values (column III) under the following conditions during 10 000 hours.

Pentode section

V_{ba} = 170 V

V_{bg_2} = 170 V

R_k = 155 Ω

Triode section

V_{ba} = 100 V

R_k = 120 Ω

LIMITING VALUES (Absolute max. rating system)

Pentode section

Anode voltage	V_{a_o}	max.	550	V
	V_a	max.	275	V
Anode dissipation	W_a	max.	2.15	W
Grid No.2 voltage	$V_{g_{2o}}$	max.	550	V
Grid No.2 voltage:				
Cathode current > 10 mA	V_{g_2}	max.	200	V
Cathode current < 10 mA	V_{g_2}	max.	225	V
Grid No.2 dissipation:				
Anode dissipation > 1.2 W	W_{g_2}	max.	0.7	W
Anode dissipation < 1.2 W	W_{g_2}	max.	0.8	W
Grid No.1 dissipation	W_{g_1}	max.	0.1	W
Negative grid No.1 voltage	$-V_{g_1}$	max.	100	V
Cathode current	I_k	max.	18	mA
Voltage between cathode and heater	V_{kf}	max.	100	V
Grid resistor (fixed bias)	R_{g_1}	max.	0.5	MΩ

LIMITING VALUES (Absolute max. rating system) (continued)

Triode section

Anode voltage	V_{a_o}	max.	550	V
	V_a	max.	275	V
Anode dissipation	W_a	max.	1.75	W
Grid dissipation	W_g	max.	0.1	W
Grid, voltage, peak value	V_{g_p}	max.	30	V
Duty factor max. 0.04				
Pulse duration max. 0.8 ms				
Grid voltage	$-V_g$	max.	100	V
Cathode current	I_k	max.	18	mA
Cathode current peak value	I_{k_p}	max.	100	mA
Duty factor max. 0.04				
Pulse duration max. 0.8 ms				
Voltage between cathode and heater	V_{kf}	max.	100	V
Grid resistor (fixed bias)	R_g	max.	0.5	MΩ
Bulb temperature	t_{bulb}	max.	170	°C

Heater voltage: The average heater voltage should be 6.3 V.
Variation of the heater voltage exceeding the range of 6.0 V to 6.6 V will shorten the tube life.
The tolerance of heater current (column II) should be taken into account.

OPERATING CHARACTERISTICS

Pentode section as R.F. amplifier

Anode supply voltage	V_{ba}	170	V
Grid No.2 supply voltage	V_{bg_2}	170	V
Cathode resistor	R_k	155	Ω
Anode current	I_a	10	mA
Grid No.2 current	I_{g_2}	2.8	mA
Mutual conductance	S	6.2	mA/V
Amplification factor grid No.2 to grid No.1	$\mu_{g_2g_1}$	40	
Internal resistance	R_i	0.4	MΩ
Input resistance at 50 MHz	r_{g_1}	10	kΩ
Equivalent noise resistance	R_{eq}	1.5	kΩ

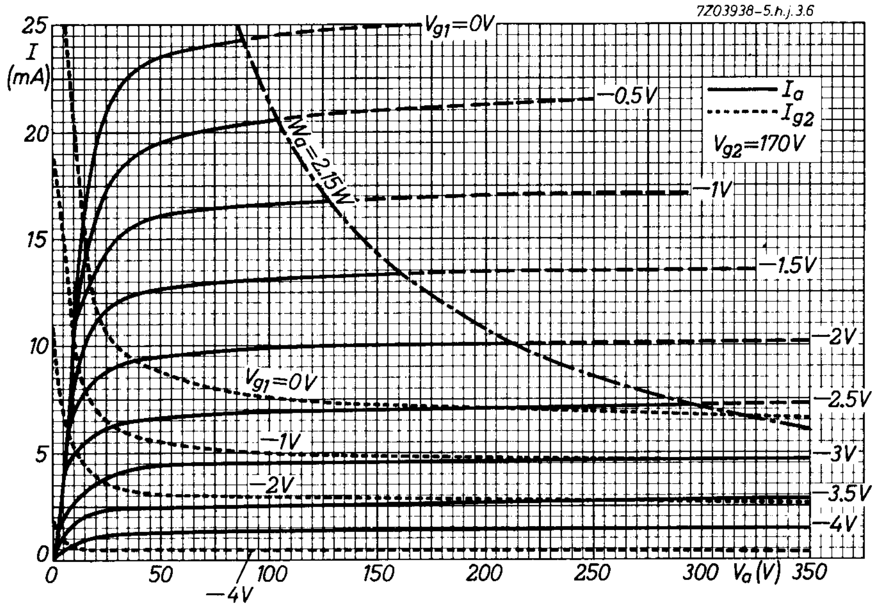
Pentode section as mixer

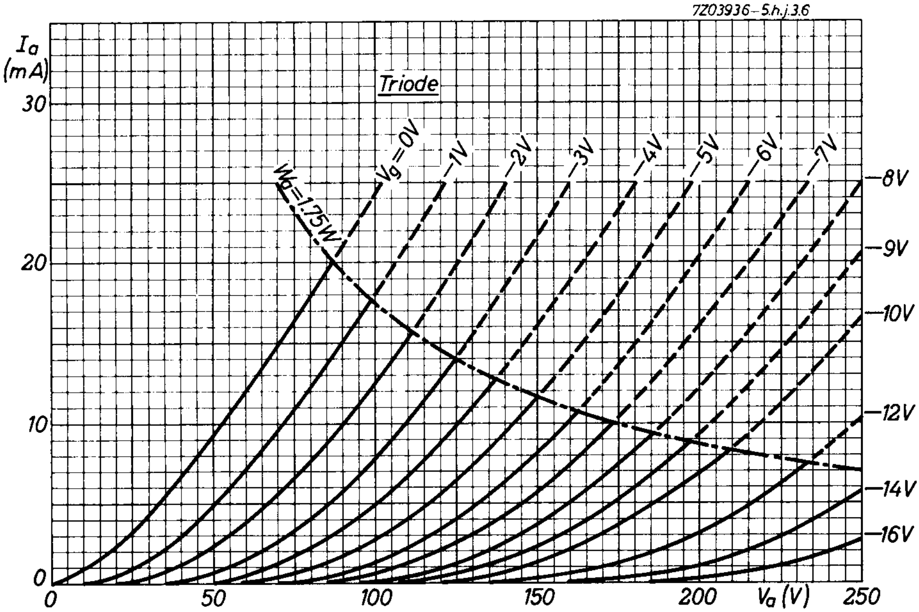
Anode supply voltage	V_{ba}	170	V
Grid No.2 supply voltage	V_{bg_2}	170	V
Grid No.1 resistor	R_{g_1}	0.1	MΩ
Cathode resistor	R_k	330	Ω
Oscillator voltage	V_{osc}	3.5	V_{RMS}
Anode current	I_a	8	mA
Grid No.2 current	I_{g_2}	2.5	mA
Grid No.1 current	I_{g_1}	12	μA
Conversion conductance	S_c	2.4	mA/V
Internal resistance	R_i	0.5	MΩ

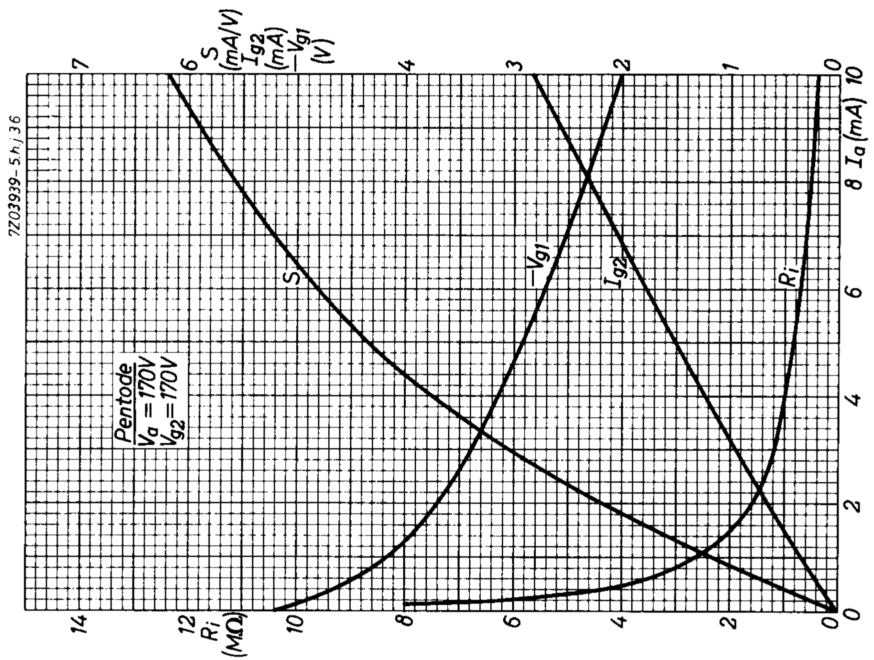
Triode as oscillator

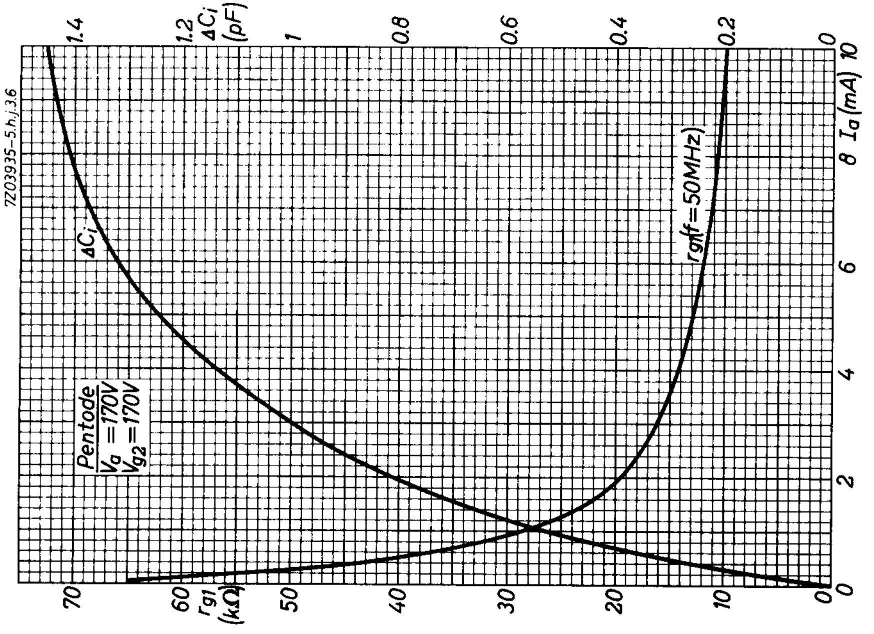
Operation in Colpitts circuit is recommended.

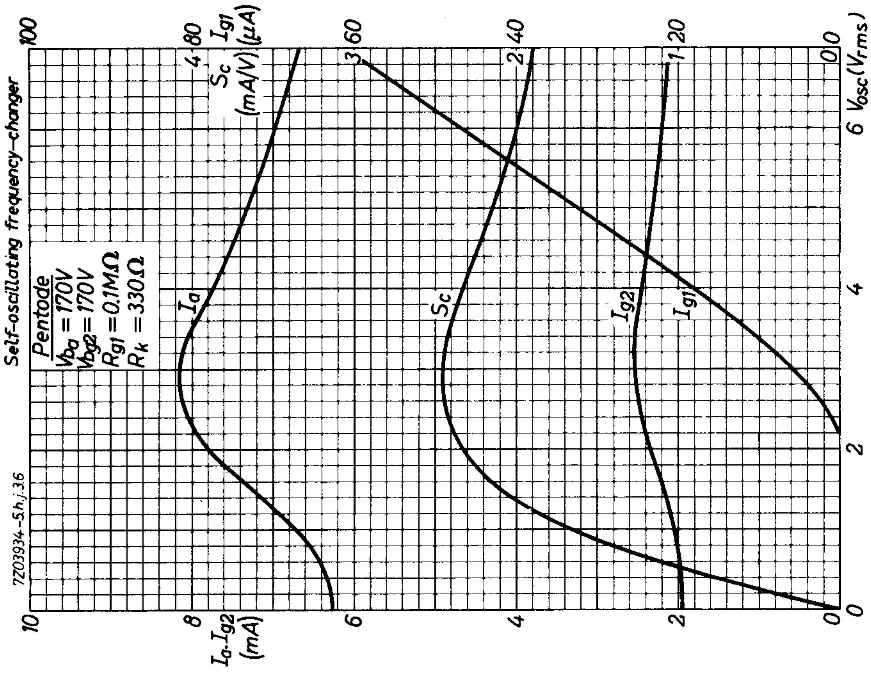
Operation in Hartley circuit is not recommended.

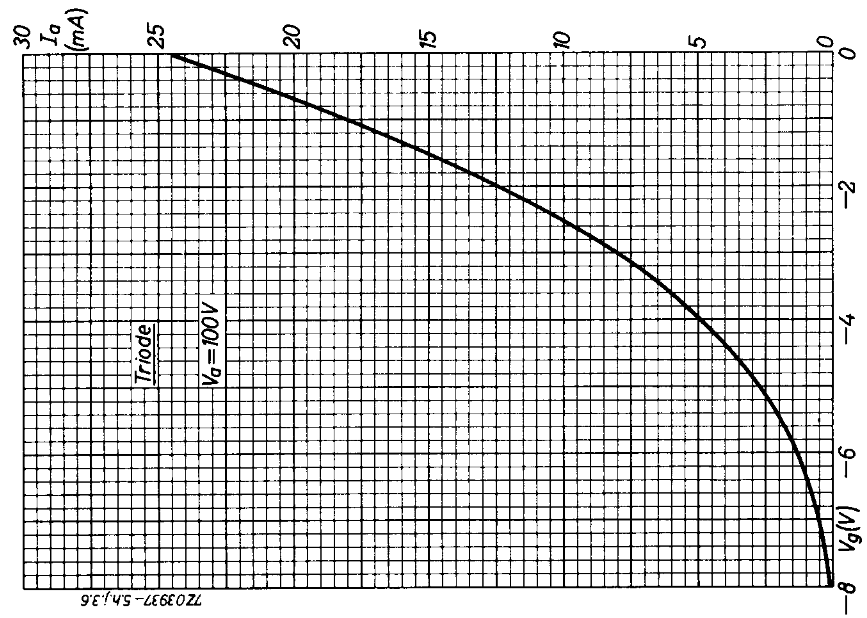

7Z03938-5.h.j.3.6
I (mA)
Vg1=0V
−0.5V
−1V
−1.5V
−2V
−2.5V
−3V
−3.5V
−4V
Wa=2.15W
Ia
Ig2
Vg2=170V
Vg1=0V
−1V
−2V
−4V
Va (V)
0
5
10
15
20
25
50
100
150
200
250
300
350

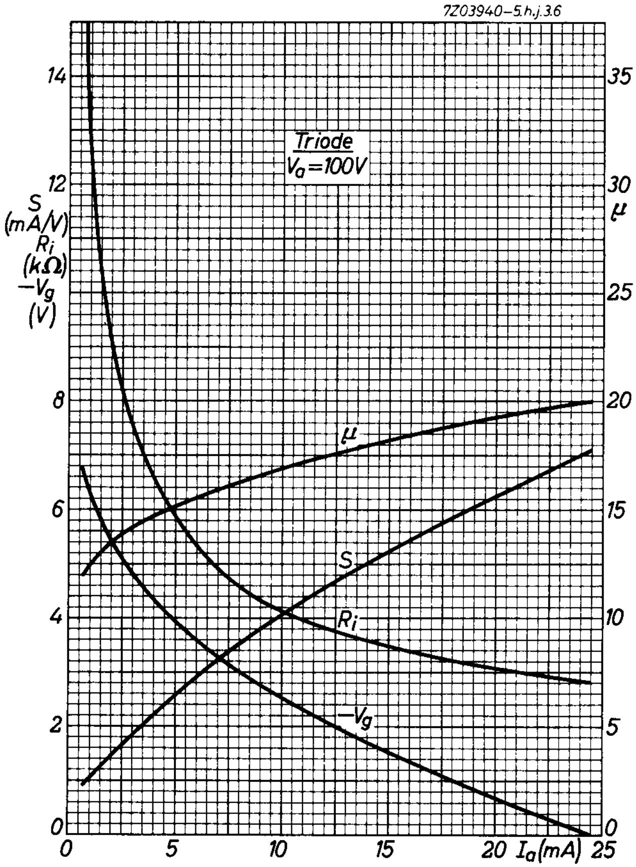

7Z03936-5.h.j.3.6
Ia (mA)
Triode
Wa=1.75W
Vg=0V
−1V
−2V
−3V
−4V
−5V
−6V
−7V
−8V
−9V
−10V
−12V
−14V
−16V
Va (V)
0
10
20
30
50
100
150
200
250


7Z03939-5.h.j.3.6
Pentode
V_a = 170V
V_{g2} = 170V
S (mA/V)
I_{g2} (mA)
$-V_{g1}$ (V)
R_i (MΩ)
S
$-V_{g1}$
I_{g2}
R_i
I_a (mA)
0
2
4
6
8
10
1
3
7
12
14


7Z03935-5.h.j.3.6
Pentode
V_a = 170V
V_{g2} = 170V
ΔC_i (pF)
r_{g1} (kΩ)
ΔC_i
r_{g1} (f = 50MHz)
I_a (mA)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
2
4
6
8
10
20
30
40
50
60
70


Self-oscillating frequency-changer
Pentode
Vba = 170V
Vbg2 = 170V
Rg1 = 0.1MΩ
Rk = 330Ω
Ia
Sc
Ig2
Ig1
Ia-Ig2 (mA)
Sc (mA/V)
Ig1 (μA)
Vosc (Vrms)
7Z03934-5.h.j.36


Triode
Va=100V
Ia (mA)
Vg(V)
7Z03937-5.h.j.36


7Z03940-5.h.j.3.6
Triode
V_a=100V
S
(mA/V)
R_i
(kΩ)
$-V_g$
(V)
μ
S
R_i
$-V_g$
0
2
4
6
8
12
14
0
5
10
15
20
25
30
35
0
5
10
15
20
I_a(mA)
25

PHILIPS

Data handbook

Electronic components and materials

E80CF

page	sheet	date
1	1	1968.12
2	2	1968.12
3	3	1968.12
4	4	1968.12
5	5	1968.12
6	6	1968.12
7	7	1968.12
8	8	1968.12
9	9	1968.12
10	10	1968.12
11	FP	2000.11.11